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Indian Standard

METHOD FOR DETERMINATION OF APPARENT DENSITY OF METALLIC POWDERS BY SCOTT VOLUMETER

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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Indian Standard

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0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 24 March 1986, after the draft finalized by the Powder Metallurgical Materials and Products Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 With the growth of powder metallurgical industry, an increasing need has been felt to bring out standards on the methods of tests for various characteristics of metallic powder in order to obtain satisfactory and comparable results. This standard is one of the series on this subject. It is hoped that the formulation of this standard will be of considerable use to the industry.

0.3 In the preparation of this standard, assistance has been derived from ISO:3923/2-1981 Metallic powders—Determination of apparent density—Part 2: Scott volumeter method, issued by the International Organization for Standardization (ISO).

0.4 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS:2-1960*.

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1. SCOPE

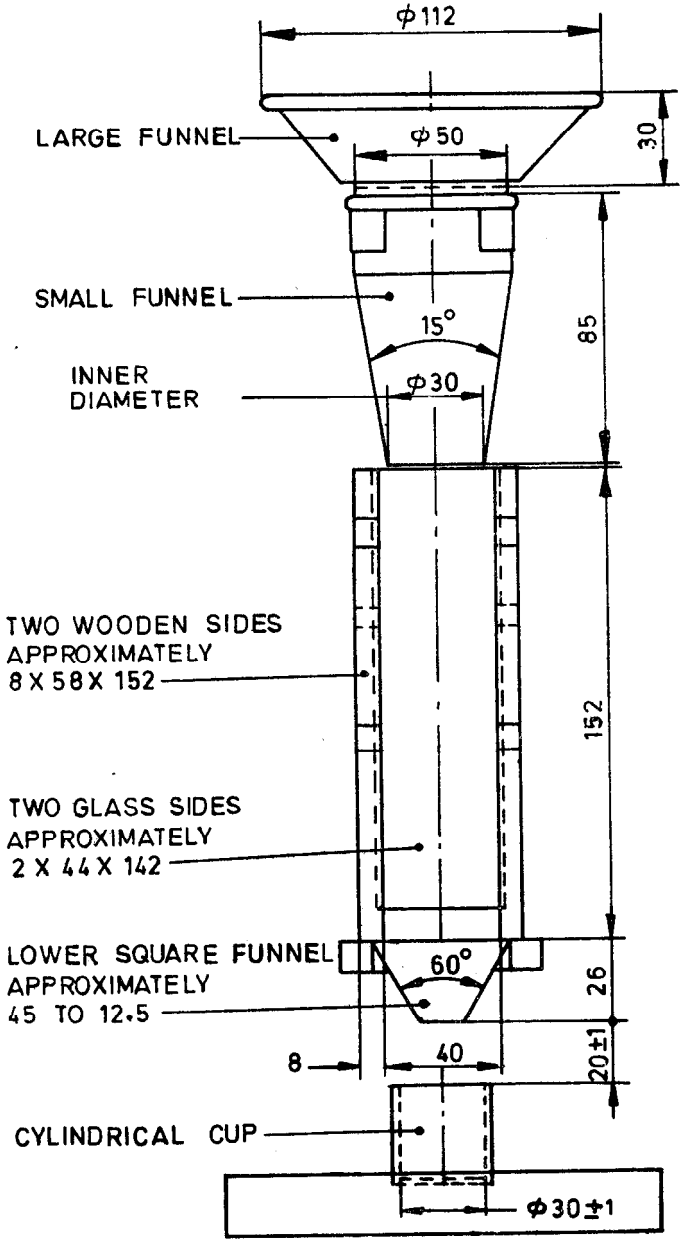
1.1 This standard specifies the Scott volumeter method for the determination of the apparent density of metallic powders. It is applicable to powders that will not flow freely through a 5-mm orifice.

2. PRINCIPLE

2.1 Measurement of the mass of a certain quantity of powder which in a loose condition exactly fills a cup of known volume.

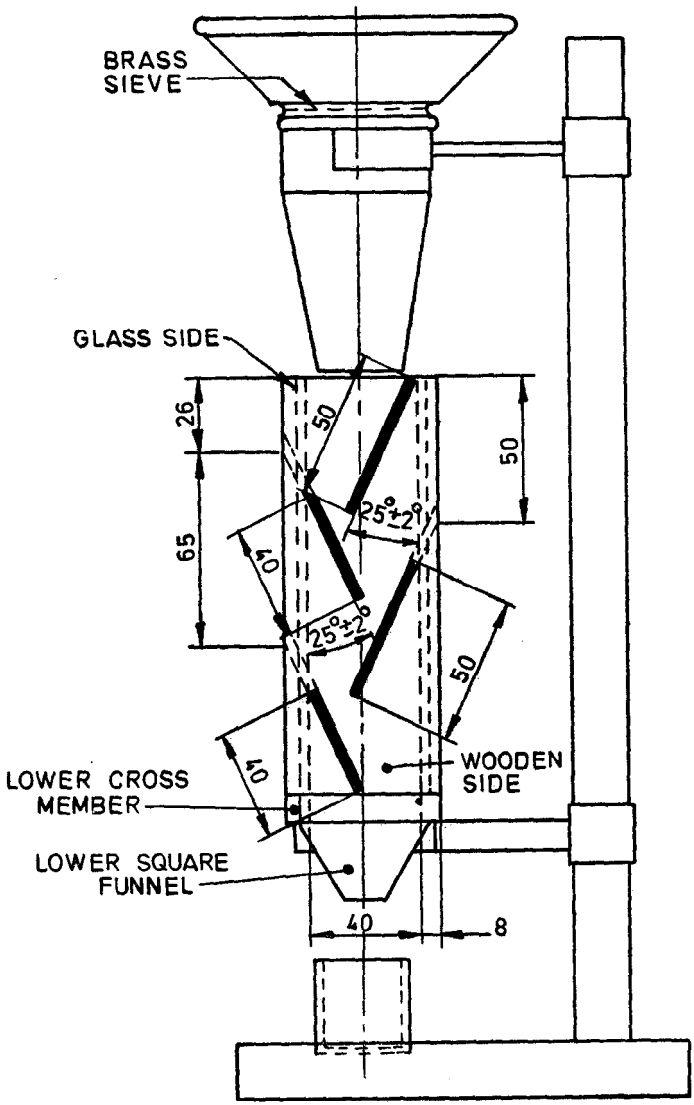
2.2 The loose condition is obtained, when filling the cup, by cascading the powder over a series of inclined plates in a Scott volumeter (*see* Fig. 1 and 2).

*Rules for rounding off numerical values (*revised*).



All dimensions in millimetres.

FIG. 1 TEST APPARATUS — FRONT VIEW



All dimensions in millimetres.

FIG. 2 TEST APPARATUS — SIDE VIEW

2.3 The ratio between the mass and the volume represents the apparent density.

3. SYMBOLS AND DESIGNATION

3.1 The description of the various symbols used in this standard are given below:

Symbol	*Designation*	*Unit*
ρ_a	Apparent density of metallic powders (general term)	g/cm^3
ρ_{as}	Apparent density obtained by the Scott volumeter method	g/cm^3
m	Mass of the powder	g
V	Volume of the cup	cm^3

4. APPARATUS

4.1 Scott volumeter — It comprises the parts given in **4.1.1** to **4.1.3**.

4.1.1 *Fnnnel* — having a large and a small conical section separated by a cylindrical section and incorporating a brass sieve of aperture size 1·18 mm (16 mesh).

4.1.2 *Baffle Box* — having a square section, and containing four glass baffles which may be located and retained by grooves in opposite sides of the box and may thus be removed for ease of cleaning. The baffles are arranged so that the powder falls on each of them in turn, thereby breaking the fall and reducing the velocity of the stream of powder. It is important that none of the powder can pass between the upper edge of the glass baffles and the sides of the baffle box. It is also important that the lower edges of the glass baffles are either in line or slightly overlap in a vertical plane.

4.1.2.1 A typical design of Scott volumeter is shown in Fig. 1 and 2. Dimensions given with tolerances are mandatory. The other dimensions represent those most frequently used and may vary slightly, provided that the principal requirement previously mentioned are maintained.

4.1.3 *Stand and Horizontal Vibration-Free Base* — to support the cup, box and funnel coaxially at the heights indicated in Fig. 1 and 2.

4.2 Cylindrical Cup — having a capacity of $25 \pm 0{\cdot}05$ cm^3 and an internal diameter of 30 ± 1 mm.

NOTE — The cup and funnels should be made of non-magnetic, corrosion-resistant metallic material having sufficient wall thickness and hardness to avoid distortion and excessive wear. The inner surfaces of the cup and funnels should be polished.

4.3 Balance — of sufficient capacity, permitting weighing to an accuracy of ± 0·05 g.

5. SAMPLING

5.1 The test sample shall be of at least 100 cm^3 volume to allow the determination to be carried out on three test portions.

5.2 In general the powder should be tested in the as-received condition. In certain instances the powder may be dried. However, if the powder is susceptible to oxidation, the drying shall take place in vacuum or in inert gas. If the powder contains volatile substances it shall not be dried.

6. PROCEDURE

6.1 Pour or feed the powder carefully by means of a spatula into the funnel until the cup is completely filled and powder flows over.

6.2 If the powder is not free flowing, its passage through the sieve may be aided by light brushing with a soft brush.

NOTE — If light brushing is not sufficient to make the powder flow through the sieve, the Scott volumeter method is not applicable to this powder.

6.3 Level the powder with a straight-edge, taking care not to compress or pull out powder and not to disturb or vibrate the cup.

6.4 After levelling the powder, tap the cup to settle the powder in order to avoid spilling it during transport. Make sure that there are no adhering particles on the exterior of the cup.

6.5 Determine the mass of the powder to the nearest 0·05 g.

6.6 Carry out the determinations on three test portions.

7. TEST RESULTS

7.1 The apparent density is given by the formula:

$$\rho_{as} = \frac{m}{V} = \frac{m}{25}$$

7.2 Report the arithmetical mean of three determinations to the nearest 0·01 g/cm^3, and the highest and the lowest results if the scatter between results exceeds 1 percent of the mean.

8. TEST REPORT

8.1 The test report shall include the following information:

a) Reference to this standard;

b) All details necessary for the identification of the test sample;

c) The drying procedure, if the powder has been dried;

d) The result obtained; and

e) Details of any occurrence which may have affected the result.